Approved For Release 2006/09/25 : CIA-RDP73-00402R000100140003-6

AREA B

"Record Protection in an Uncertain World"

WORLD CONFERENCE ON RECORDS AND GENEALOGICAL SEMINAR

Salt Lake City, Utah, U.S.A.
5-8 August 1969

MINIATURIZATION OF RECORDS

Part III

High Reduction Microfilm Technology, Techniques, and Systems

By

David R. Wolf
Yerkes-Wolf Associates

COPYRIGHT© 1969 THE GENEALOGICAL SOCIETY OF THE CHURCH OF JESUS CHRIST OF LATTER-DAY SAINTS, INC.

Approved For Release 2006/09/25 : CIA-RDP73-00402R000100140003-6

AREA B 4 & 5 c

Approved For Release 2006/09/25 : CIA-RDP73-00402R000100140003-6

MINIATURIZATION OF RECORDS

Part III

High Reduction Microfilm Technology, Techniques, and systems

By

David R. Wolf
Yerkes-Wolf Associates

Microfilm is in its fifth decade of modern use as an information recording medium. Today, the process of taking pictures of documents, book pages, photographs, and other graphic records is well within the comprehension and potentially within the scope of activity of nearly everyone. Accordingly, microfilm has been used for the procedural recording of business records, scholarly interchange, and the building of research collections and protective archives for some forty years. None of us familiar with this medium cease to marvel at the usefullness of massive collections like that of The Genealogical Society -- or those so small that they can be held in one hand.

The introduction within the last decade of improved film and cameras, new formats, better reproduction equipment and readers, and reader-printers served to enhance existing applications and awaken others to microfilm as an information medium. One can observe that the power and usefullness of a medium increases with its ability to transfer information. From a microfilm of our record we can produce an information display, enlarged hard copy, printing plates for the prepartion of hard copies for distribution, other microforms and microfilm copies for distribution, or further reduced microfilm formats. Thus microfilm is no longer simply a recording medium but has become a powerful information transfer medium.

Refinement in microduplication - the reproduction of microfilm as microfilm - led to expanded use as a publishing medium. In the last half decade, we have seen this use grow from a modest level to a rapidly expanding one involving the publication of technical documents, catalogs, parts lists, and other collections by governmental, industrial, and commercial organizations. Growth of interest in micropublishing coupled with research and development in the laboratories of our industry lead us then to my topic today -- High Reduction Microfilm.

Before we get into the technology, some definitions may be in order. Most microrecording is done at linear reductions in the range 12/1 to 30/1. At reductions in this range, we can record from 60 to 100 document pages on one 4 by 6 inch microfiche or the content of a well organized file drawer on one 100 foot roll of film. Today, high reduction microrecording is defined as reduction one order of magnitude higher -- or linear reductions in

Approved For Release 2006/09/25 : CIA-RDP73-00402R000100140003-6

Approved For Release 2006/09/25 : CIA-RDP73-00402R000100140003-6

the range 120/1 to 300/1. At reductions in this range, we can record from 3000 to 10,000 document pages on one 4 by 6 inch ultrafiche or high reduction microfiche.

High reduction microphotographic recordings are not new. Using special photographic emulsions, the New Testament had been recorded in an area about the size of a pin head over one hundred years ago. As was the case with microfilm however, reduction of the technology to modern commercial practice had to await need as the mother of reinvention.

Today, two commercial methods of high reduction microrecording are available. At present, both are used on a service basis, that is, documents are converted under rigid controls in a service facility. While the PCMI system of the National Cash Register Company and the MDS system of Microform Data Systems, Inc. are similar in many respects, each warrants description.

The PCMI system takes its name from and was developed out of basic research on photochromic materials by NCR. A photochromic material can be defined as one which will respond to radiant energy by producing a visible image. The heart of the PCMI system is a photochrome coating which can be imaged by light of one wavelength and erased by light of a longer wavelength. Since the photochromic image is a dye, it is grainless and capable of high resoltuion.

The first step in the PCMI process is the reduction of document pages to 35mm. film at 1/15th their original size. For this, a standard planetary camera modified to assure precision of image placement and film pull-down is used. A density control panel is recorded with each image.

Following the carefully controlled processing of the 35mm. film, the images are further reduced 10 diameters in a PCMI camera recorder onto a PCMI plate. The PCMI plate is prepared by coating the photochromic material on a precision ground glass plate under "clean room" conditions. Exposures in this second reduction are controlled by measurement of the density developed in the image of the density control panel recorded with each document image on the input film. The operator of the camera recorder can inspect the images on the photochromic plate, erase, and re-record any unsatisfactory images.

Upon completion of the photochromic plate, the 3000 images at 1/150th the original size are contact printed to a reproduction master plate. This plate is a precision ground glass plate which has been coated with a Lippman silver emulsion. The photochromic plate is then placed in cold storage to preserve the images.

Following development and inspection of the Lippman plate, it is used for the contact exposure of the distribution transparencies on a high resolution silver film. Following development and inspection of this film, it is laminated between protective layers of film and cut into high reduction microfiche for distribtuion.

Approved For Release 2006/09/25 : CIA-RDP73-00402R000100140003-6

Approved For Release 2006/09/25 : CIA-RDP73-00402R000100140003-6

NCR currently offers a reader for the PCMI transparencies. The film carrier for the transparency is designed to indicate X and Y position providing rapid location images. Cost of the reader ranges from $700 to below $500 in large quantity.

The basic MDS system was acquired by Microform Data Systems from Republic Aviation where it was developed out of the need to "package" a considerable amount of information at a high reduction. The first step in this system uses a precision camera to reduce input document pages to 35 mm. microfilm at reductions up to 26/1.

Using a special fixed reduction camera, the 35mm. film images are then reduced ten diameters to a spectrophotographic emulsion. The resulting master, containing up to 10,000 pages in a 100 x 100, 4 x 5 inch matrix, is then used to contact expose a high resolution film. Development, lamination, and chopping of this film results in the high reduction microfiche for distribution.

Prototypes of readers designed for varied ultrafiche formats and providing various modes of image location from manual to digital input auto-location have been shown. At the time of this writing, specific model/price information was not available.

At normal reductions, one can store approximately three-quarters of a million document pages in microfiche format in one cubic foot. In high reduction fiche format, at 250/1, the theoretical storage density in one cubic foot is 85 million document pages. For those of you oriented to the storage of information as bits, these densities equate to seven billion bits at 24/1 and eight hundred billion bits at 250/1 for typed pages stored in graphic or analog form.

From the foregoing, it is obvious that high reduction microforms offer a very high storage density or savings in space. This, however, is not the significant consideration in their application. Far more important are the ease of file maintenance and the low cost of information distribution in micropublishing systems. When one considers the precision involved in the preparation of the high reduction master or the fact that the work must be done in "clean room" conditions since a speck of dust could mask several pages, the fact that the master may cost several hundred dollars becomes obvious. However, analagous to the economics of printing, the power of the system is in the preparation of distribution copies. In ultrafiche form, we can produce distribution copies of 3000 to 10,000 pages for about one dollar in reproduction cost per copy.

Based on these economics, it is obvious that high reduction microfilm systems are applicable today only for micropublishing where the cost of the master can be spread over many distribution copies. As mentioned earlier, for micropublishing an equally important factor is file maintenance. When collections of several hundred pages can be distributed to many reference stations as a few dozen ultrafiche, the ease of file maintenance and operating control can be an all important system consideration. There are other systems considerations both pro and con for high reduction microforms. However, in the few minutes remaining we might look to the future.

Approved For Release 2006/09/25 : CIA-RDP73-00402R000100140003-6

Approved For Release 2006/09/25 : CIA-RDP73-00402R000100140003-6

What does the future hold? We seem to be limited only by our imagination *or* by our ability to define our needs.

In the laboratory we have seen ultra-micro-photo-graphic reductions of 50,000 diameters. This could mean one million five-hundred-page books on one post card.

Progressing in the other direction, there is pressure to produce the "book" microfiche. At 24 to 1, we can record documents up to 100 pages on microfiche. Increasing reduction one order of magnitude to 250 to 1, we can record collections, up to 10,000 pages, on one micro-microfiche. At reductions of 40 to 60 diameters, we could record 400 to 800 pages -- or most books -- on one intermediate reduction microfiche. Such a development is easily within application of present technology, commercialization has already been initiated for micropublishing, and we can expect more developments in this area.

Holographic recording, using the energy of lasers, and other coherent energy sources, may never be used to produce high reductions. However, since it is possible to superimpose images on holograms, high density recording and storage is envisioned.

As we use computers increasingly to process certain types of information, computer output to microform for both improved reference to and distribution of the output increase in importance. Here again, we may only be limited by our imagination and need. Experimentally, high quality intermediate reductions have been produced and high reduction microfilm ouput for computers is within reason.

As we learn more about our true requirements in information processing and transfer, as we better understand our probelms, both systems design and the application of the available technology and development of new technology will progress at accelerating rates. We expect microphotographic technology to play an increasingly important role. Obviously, we must all constantly be alert to new developments and devote studious attention to our true requirements. In the spirit of this thought, it has been my pleasure to discuss High Reduction Microfilm briefly with you today.

Approved For Release 2006/09/25 : CIA-RDP73-00402R000100140003-6